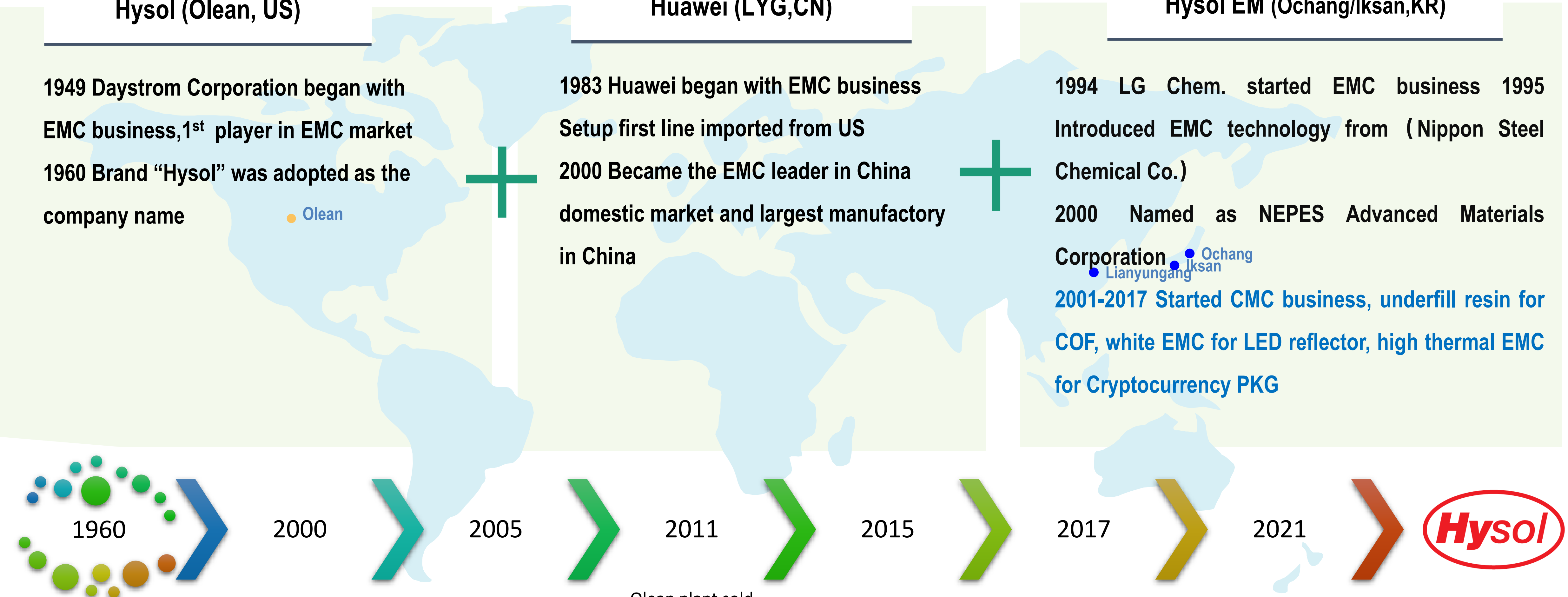
HYSOL Huawei EMCs

Hysol Huawei Electronics Co., Ltd.

CONTENT

History of Business



Hysol (Olean, US)

1949 Daystrom Corporation began with EMC business,1st player in EMC market

1960 Brand “Hysol” was adopted as the company name

+

Huawei (LYG,CN)

1983 Huawei began with EMC business

Setup first line imported from US

2000 Became the EMC leader in China domestic market and largest manufactory in China

+

Hysol EM (Ochang/Iksan,KR)

1994 LG Chem. started EMC business 1995 Introduced EMC technology from（Nippon Steel Chemical Co.）

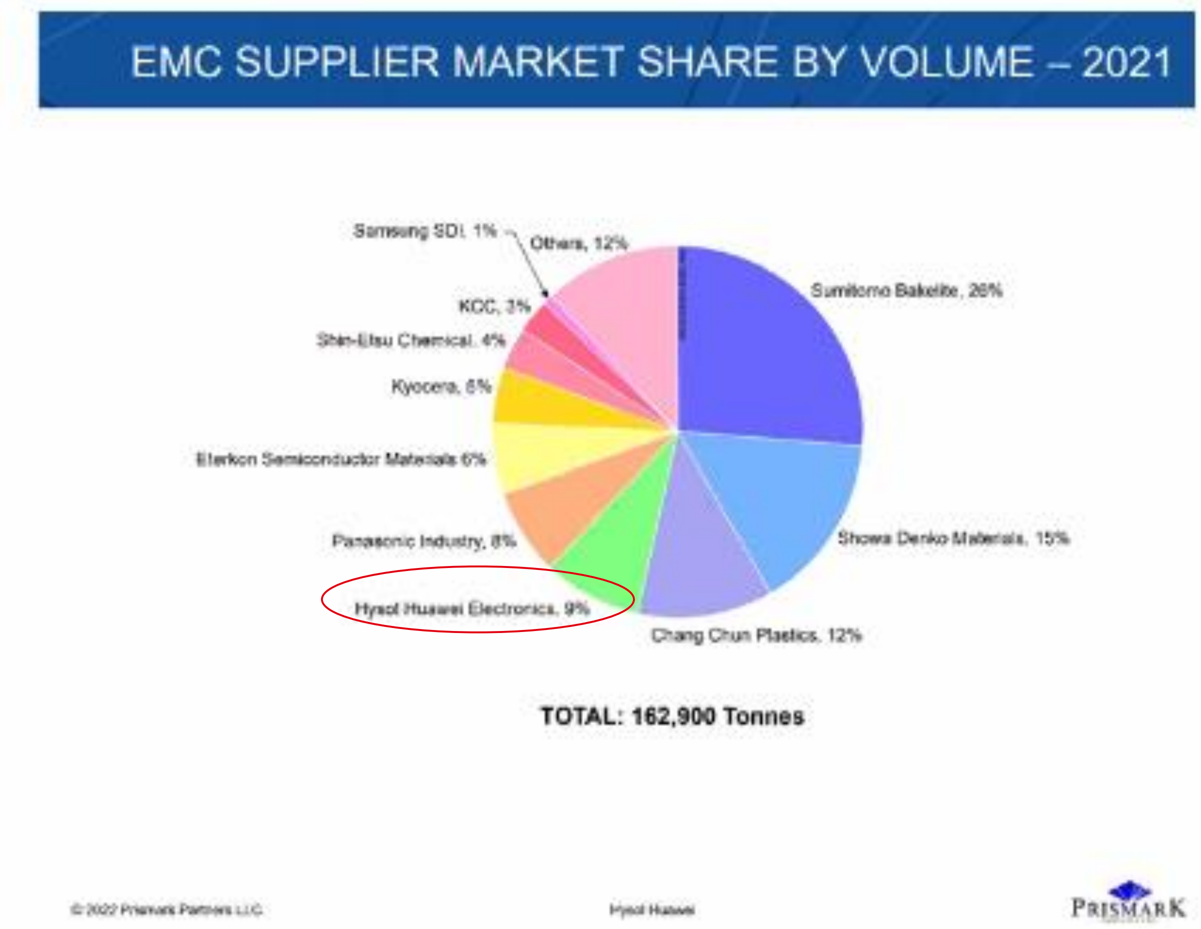
2000 Named as NEPES Advanced Materials Corporation

2001-2017 Started CMC business, underfill resin for COF, white EMC for LED reflector, high thermal EMC for Cryptocurrency PKG

- **1960** – Brand “Hysol” was adopted as company name
- **2000** – Henkel acquired Dexter and started epoxy mold compound business
- **2005** – Henkel Huawei Electronics (HHE) JV established
- **2011** – Olean plant sold to toll manufacture, HHE fully integrated into Henkel system
- **2015** – Henkel owned 100% share of HHE
- **2017** – Hysol Huawei established after HHE acquired by Shanghai Hengsuo material
- **2021** – Hysol Huawei owned Hysol EM

Hysol

Where are we?



EMC SUPPLIER MARKET SHARE BY VOLUME – 2021

TOTAL: 162,900 Tonnes

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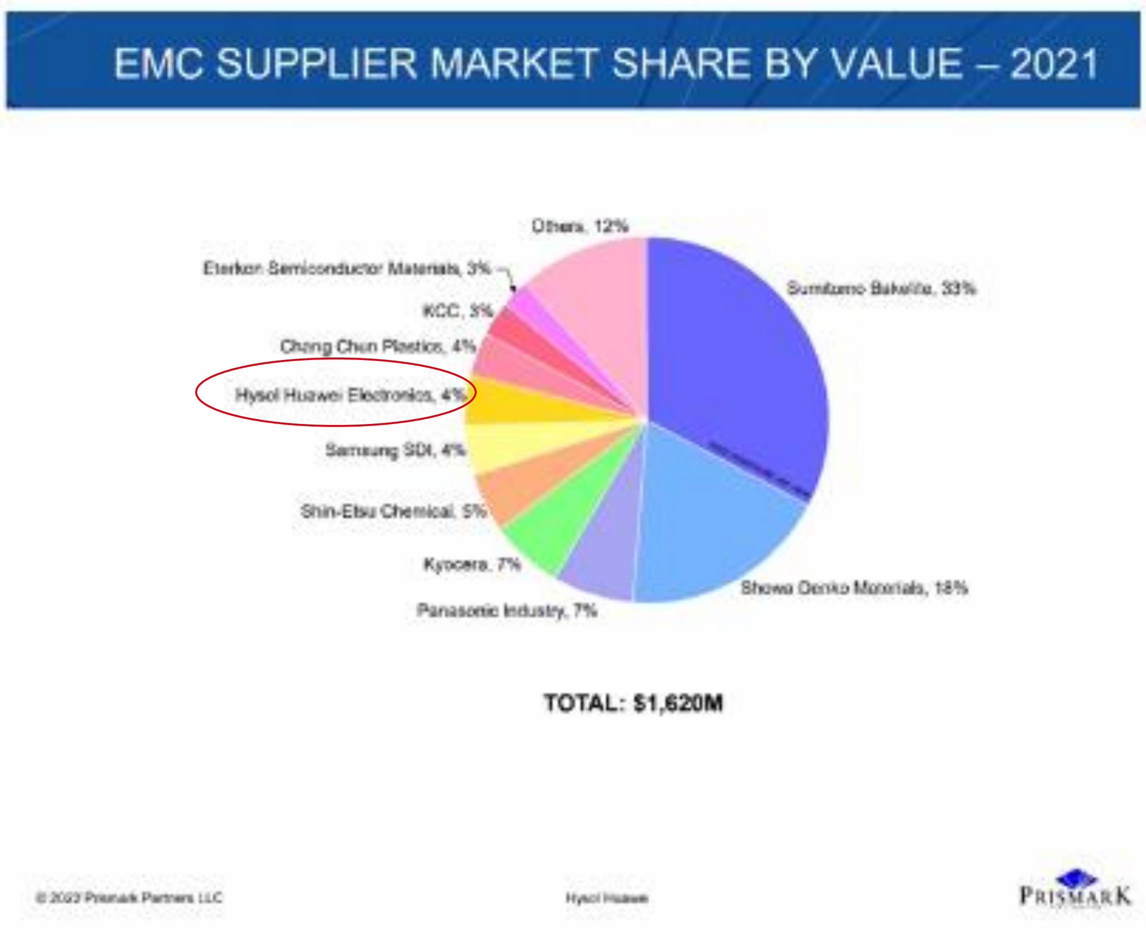
Hysol Huawei

PRISMARK



EMC SUPPLIER MARKET SHARE BY VALUE – 2021

TOTAL: $1,620M

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Hysol Huawei

PRISMARK

2021年按全年使用量统计排名： 全球第四，国内第一

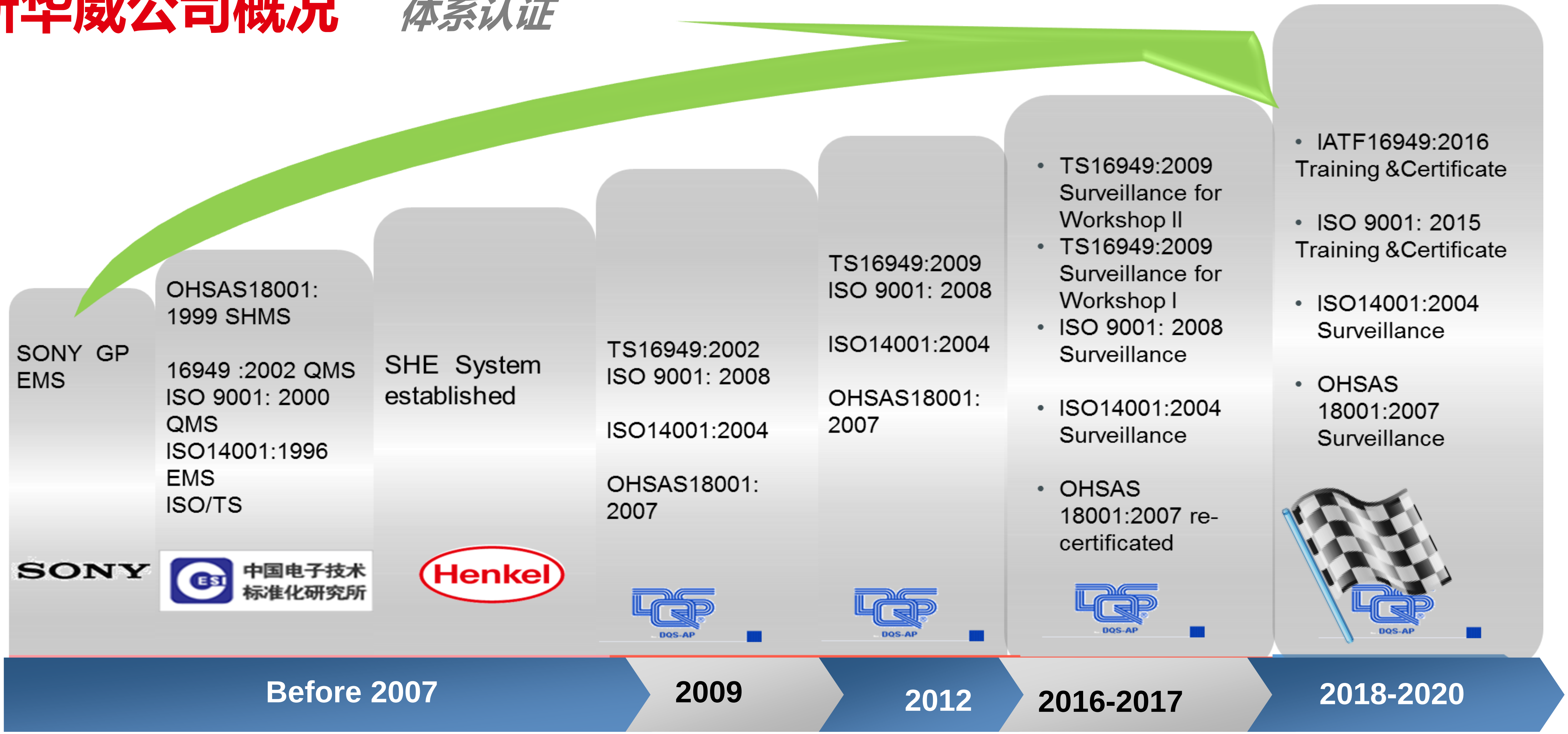
2021年按全年销售额统计排名： 全球第七，国内第一

data source: PRISMARK

Hysol Huawei Overview

Core business	Mold Compound Manufacturing, Quality, Product Development & Sales, Service
Employees	~430
Total area	102,000 sqm
Address	Songtiao Industrial Park, Lianyungang (China)

衡所华威公司概况 *体系认证*



SONY GP EMS

OHSAS18001: 1999 SHMS

16949 :2002 QMS
ISO 9001: 2000 QMS
ISO14001:1996 EMS
ISO/TS

SHE System established

TS16949:2002
ISO 9001: 2008

ISO14001:2004

OHSAS18001: 2007

TS16949:2009
ISO 9001: 2008

ISO14001:2004

OHSAS18001: 2007

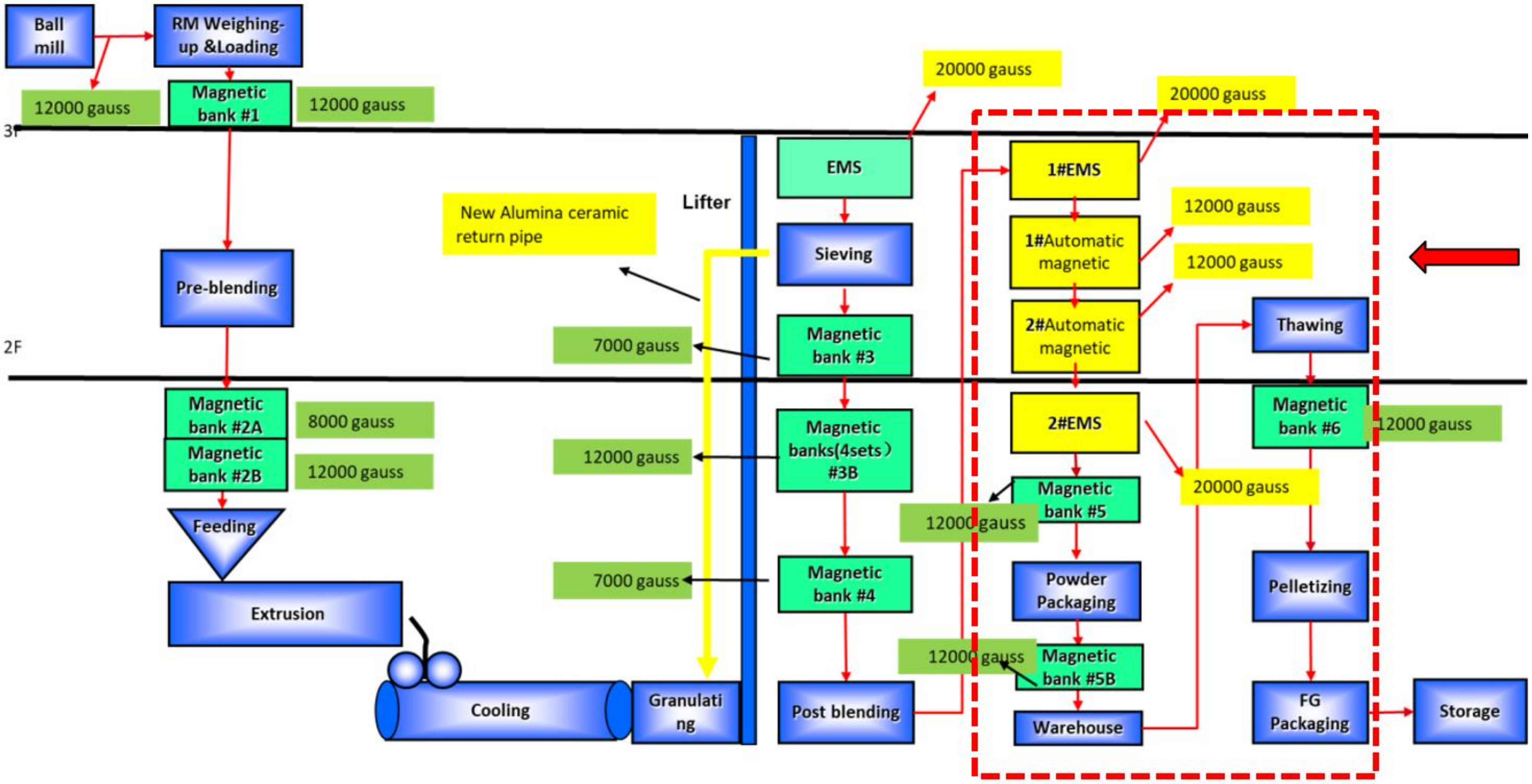
- TS16949:2009 Surveillance for Workshop II
- TS16949:2009 Surveillance for Workshop I
- ISO 9001: 2008 Surveillance
- ISO14001:2004 Surveillance
- OHSAS 18001:2007 re-certificated

- IATF16949:2016 Training &Certificate
- ISO 9001: 2015 Training &Certificate
- ISO14001:2004 Surveillance
- OHSAS 18001:2007 Surveillance

Before 2007 | 2009 | 2012 | 2016-2017 | 2018-2020

- 当前公司**30%**以上的订单应用于技术等级要求较高的汽车电子；
- **IATF16949、ISO9001/14001、OHSAS18001**等质量和安全认证体系均在公司周期性维护中。

Flow Chart of Hysol EMC for Automotive



Remove magnetic impurities

Hysol Mold Compound References

At International Accounts for Automotive

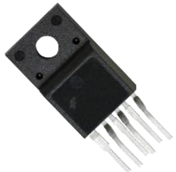
Hysol EMC Type	Package Type	Customer Production Locations	Automotive End User
Hysol GR21F-02	Diodes	Europe	YES
Hysol GR2310 series	Ta Caps (MnO)	Europe, Latin America, USA	YES
Hysol GR646	SOT series	China, SE Asia	YES
Hysol GR825	SOIC	Taiwan, Malaysia, Mexico	YES
Hysol GR9810-1P	Sensors	Europe	YES
Hysol MG15F-0140	SOT227	Korea, SE Asia	YES
Hysol MG15F-35A	Power TO	Latin America, SE Asia	YES
Hysol MG21F-02	Diodes	China, Europe, Latin America	YES
Hysol MG27F-0521LF	Ta Caps (MnO)	Europe, USA	YES
Hysol MG33F series	Miscellaneous	Europe, Latin America, USA	YES
Hysol MG35F	Sensors	SE Asia	YES
Hysol MG36F-25A	Sensors, TOP	Europe, SE Asia	YES
Hysol MG40F series	Miscellaneous	Europe, Middle East	YES
Hysol MG46F-AM	DIP	China	YES
Hysol MG52F	Sensors	SE Asia	YES
Hysol MG52F-99B	DPAK	SE Asia	YES
Hysol MG57F-0660	Ta Caps (MnO)	Latin America, USA	YES
Hysol PF9AS	DIP	Malaysia, Mexico	YES

HYSOL HUAWEI COMPOUND PRODUCT PORTFOLIO (1)

THROUGH HOLE DEVICES

PERFORMANCE / VALUE

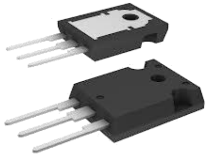
HALOGEN FREE
(“DARK GREEN”)



Thermal conductivity =2W/mK

- **HYSOL GR 50HT**
- **HYSOL KL G500HT**
- **HYSOL MG 50HT**
- **HYSOL KL 5000-HT**

TO 220F / 3PF (FULLPACK)



Good electrical performance

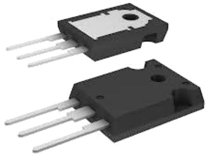
- **HYSOL MG 15F-35A**
- **HYSOL GR 30**
- **HYSOL GR 300**
- **HYSOL GR 260(IMP)**
- **HYSOL KL 1000-3LX**

TO 92 / 220 / 247 (<900V)

Good electrical performance

- **HYSOL GR 21F-02**
- **HYSOL MG 21F-02**
- **HYSOL KL G100**
- **HYSOL KL 1000-3NP**

(AXIAL) DIODE



Excellent electrical performance

- **HYSOL GR 750**
- **HYSOL MG 15F-MOD2/MOD2C**
- **HYSOL MG 15F-0140R**

Higher Power (Tg >190ºC)

TO / DIODE (600V-1800V)

High reliability

- **HYSOL GR 60/GR60PT**
- **HYSOL GR 360A-ST**
- **HYSOL PF 9AS**
- **HYSOL KL 1000-3A**

DIP / SIP / SPM / IPM

HYSOL HUAWEI COMPOUND PRODUCT PORTFOLIO (2)

SURFACE MOUNT DEVICES

PERFORMANCE / VALUE

HYSOL GR 600/ 700

HYSOL GR 2811 *)

HYSOL GR 2727

HYSOL GR 2710 *)

HYSOL GR 2330 **)

HYSOL GR 2310 *)

HYSOL KL G100S

TANTALUM CAPACITOR

HYSOL GR 720

HYSOL GR 640HV-L1 LS1C

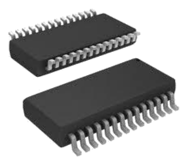
HYSOL GR 640HV-FF/P

HYSOL GR 640HV-L1

HYSOL GR 646

HYSOL KL G100S

SOT / SOD / SMX



MSL1

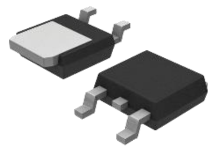
HYSOL GR 700/710F

HYSOL GR 828FC1

HYSOL GR 510

HYSOL GR 825

SOIC / QFP



MSL1

HYSOL GR 750

HYSOL GR 700

HYSOL GR 600

HYSOL KL G680H

DPAK / D2PAK

MSL1

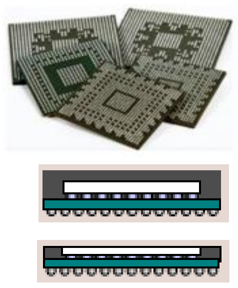
HYSOL GR 900

HYSOL GR 9810-1P

HYSOL ***) GR 17F

HYSOL GR 640A-ST8

SENSOR / MODULE



MSL3~2

HYSOL GR 920

HYSOL GR 910

Thermal conductivity 3~5W/mK

HYSOL GR 730HT

ADVANCED PACKAGE

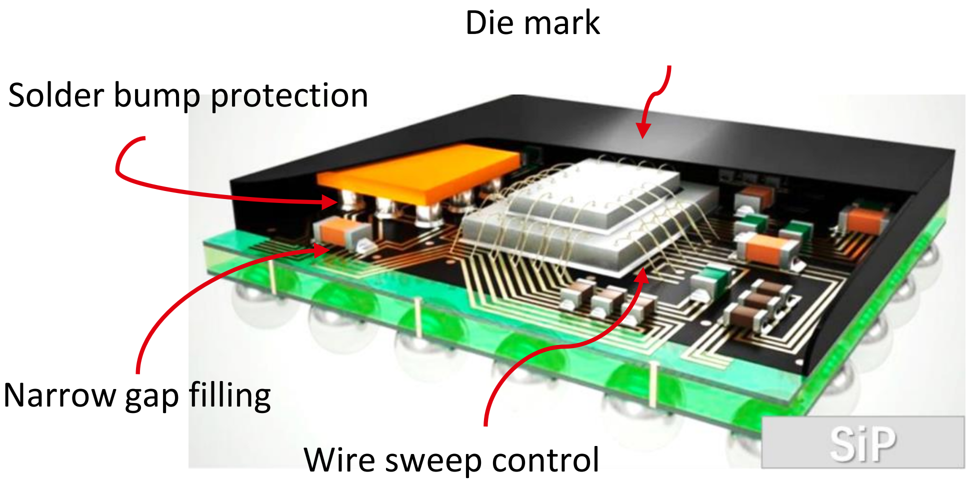
**) GOLD color, BLACK 2320, 2720 & 2821 versions available*

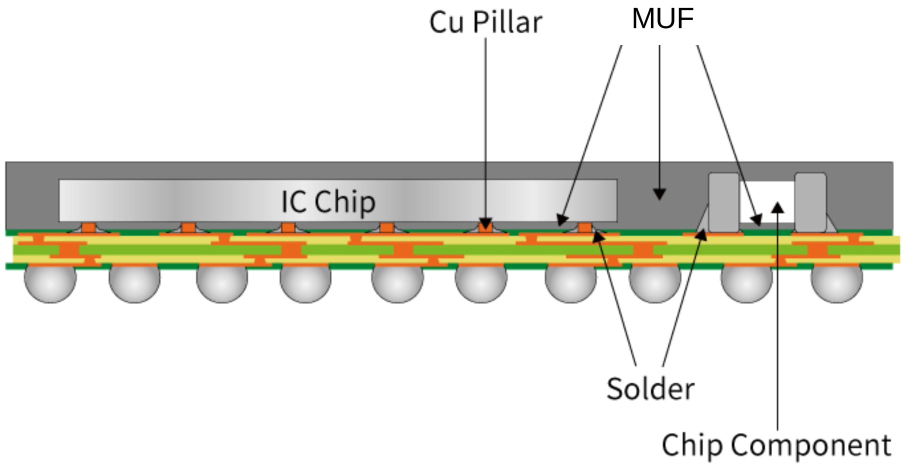
***) ORANGE color for Niobium capacitor*

****) WHITE color for Opto Coupler*

HYSOL GR920

HYSOL solution for advanced packaging





- Good reliability performance on advanced packaging
- Excellent narrow space filling.
- Meet MSL3~MSL2/260C requirement.
- Outstanding warpage control(unit warpage＜80 μm).
- Meet UL94 V-0 flammability rate at 1/8 inch thickness.

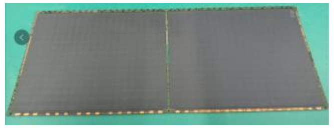
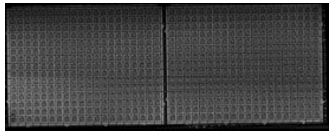
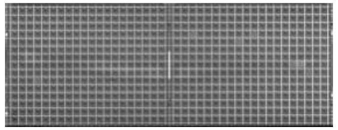
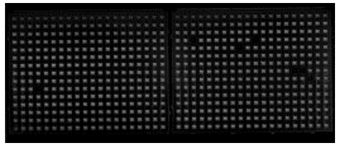
TYPICAL MUF PROPERTIES

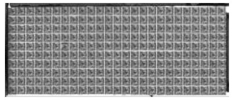
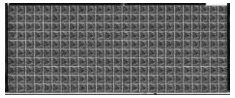
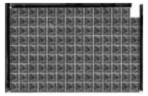
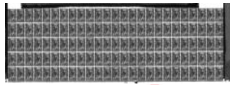
EMC Type			GR920 (H4)	GR920 (Q2)	GR920 (M12)	GR920 (L20)	GR920 (A1)
Formula info	Resin		MAR	MAR/MF	BP/MAR	MAR/MF	BP
	Hardener		MAR	MAR/MF	MAR	MAR/MF	PN/MF
	Filler ratio（%）		84	85	88.5	88	87.5
	Filler cut （μm）		20	20	20	20	20
	Filler type		Spherical	Spherical	Spherical	Spherical	Spherical
Spiral flow		inch	60	56	39	36	66
Gelation time		sec	34	39	37	34	46
Shore D Hardness		-	76	77	76	81	80
Tg (TMA)		℃	102	138	120	158	150
a1 (TMA)		10^{-6}/℃	14	12	10	9	9
a2 (TMA)		10^{-6}/℃	43	45	35	33	34
Flexural Modulus at RT		MPa	13500	15500	19500	17800	21000
Flexural Strengths at RT		MPa	125	146	120	154	138
Modulus by DMA	25℃	MPa	21000	20700	24000	25914	24000
	175℃	MPa	350	1200	950	2119	2000
	260℃	MPa	235	650	650	1203	1100
Tg (DMA, peak of tanδ)		℃	113	146	127	156	151
Shrinkage after PMC		%	0.36	0.26	0.13	0.2	0.19

BETA SITE PERFORMANCE IN HT**

Grade	Unit	Commercial	GR920L20
Filler content	%	88	88
Filler size	um	20	20
Epoxy	-	-	MAR/MF
Hardener	-	-	MAR/MF
SF	inch	39	36
GT	s	30	34
Shore-D hardness	-	83	81
Viscosity	Pa.s	10	29
Tg(TMA)	℃	142	158
CTE1	ppm/℃	9	9
CTE2	ppm/℃	37	33
Tg (DMA)	℃	150	156
Flexural Modulus at RT	MPa	19500	15299
Flexural Strengths at RT	MPa	175	154
Storage modulus 25℃	MPa	25000	25914
Storage modulus 175℃	MPa	3000	2119
Storage modulus 260℃	MPa	1200	1203
Moisture absorption (PCT 24Hours)	%	0.38	0.37
Shrinkage after PMC	%	0.18	0.21

FCCSP	Mold cap	Strip size	PKG	Die size	Bump height
	0.4mm	240.5*95*0.22mm	5.4*5.4mm	3.3*2.8*0.15mm	65um

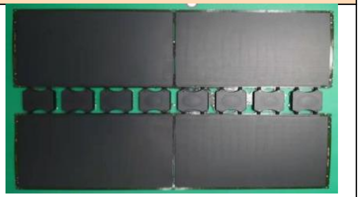
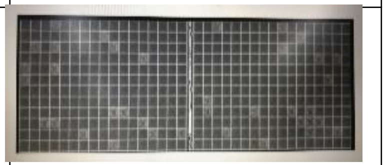
Item	GR920L20
Appearance	
C-scan	
T-scan	
Bump-scan	
Warpage	short side 2.07mm long side 2.11mm
Marking	OK

Test Item*	Qualification Test Condition	Test Result		
		results	criterion	SAT
Before Test	/	PASS	NA	
Pre-con	Baking:125，24 hrs Moisture Soak: 30℃/60%RH,192hrs Reflow@260 *3times	PASS	J-STD-020E	
uHAST	130℃, 85%RH 33.3psia,unbiased 192hrs	PASS	JESD22-A118B	
TCB	-55℃~125℃, 1000cycles	PASS	JESD22-A104E	

BETA SITE PERFORMANCE IN JC**

Grade	Unit	Commercial	GR920L20
Filler content	%	88	88
Filler size	um	20	20
Epoxy	-	-	MAR/MF
Hardener	-	-	MAR/MF
SF	inch	39	36
GT	s	30	34
Shore-D hardness	-	83	81
Viscosity	Pa.s	10	29
Tg(TMA)	℃	142	158
CTE1	ppm/℃	9	9
CTE2	ppm/℃	37	33
Tg (DMA)	℃	150	156
Flexural Modulus at RT	N/mm^2	19500	15299
Flexural Strengths at RT	N/mm^2	175	154
Storage modulus（25℃）	N/mm^2	25000	25914
Storage modulus（175℃）	N/mm^2	3000	2119
Storage modulus（260℃）	N/mm^2	1200	1203
Moisture absorption (PCT 24Hours)	%	0.38	0.37
Shrinkage after PMC	%	0.18	0.21

FCCSP	Mold cap	Strip size	PKG	Die size	Bump height
	0.365mm	240*95*0.18mm	6.3*6.9mm	6.35*5.57*0.15mm	80um

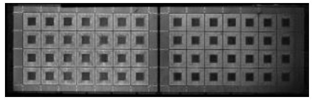
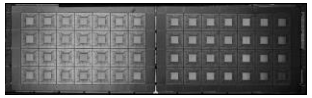
Item	GR920L20
Appearance	
C-scan	
T-scan	
Strip warpage	2~3mm
Marking	OK

Test Item*	Qualification Test Condition	Test Result	
		results	criterion
Before Test	/	PASS	NA
Pre-con	Baking:125，24 hrs Moisture Soak：30℃/60%RH,192hrs Reflow@260*3times	PASS	J-STD-020E
uHAST	130℃, 85%RH 33.3psia,unbiased 192hrs	PASS	JESD22-A118B

BETA SITE PERFORMANCE IN HJ**

Grade	Unit	Commercial	GR920A1
Filler content	%	88	87.5
Filler size	um	20	20
Epoxy	-	-	BP
Hardener	-	-	PN/MF
SF	inch	39	66
GT	s	30	46
Shore-D hardness	-	83	80
Viscosity	Pa.s	10	11
Tg(TMA)	℃	142	150
CTE1	ppm/℃	9	9
CTE2	ppm/℃	37	34
Tg (DMA)	℃	150	151
Flexural Modulus at RT	N/mm^2	19500	21000
Flexural Strengths at RT	N/mm^2	175	1138
Storage modulus（25℃）	N/mm^2	25000	24000
Storage modulus（175℃)	N/mm^2	3000	2000
Storage modulus（260℃)	N/mm^2	1200	1100
Moisture absorption (PCT 24Hours)	%	0.38	0.38
Shrinkage after PMC	%	0.18	0.19

FCCSP	Mold cap	Strip	PKG	Die size	Bump height
	0.37mm	240*76.3*0.35mm	14*14mm	6*6*0.12mm	70um

Item	GR920A1
Appearance	
C-scan	
T-scan	
Warpage	2mm
Marking	OK

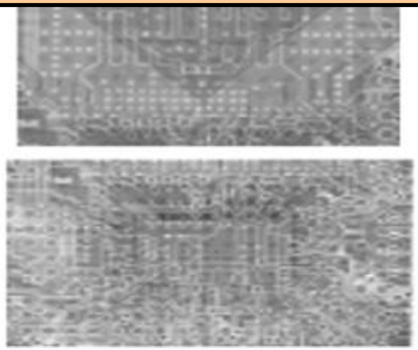
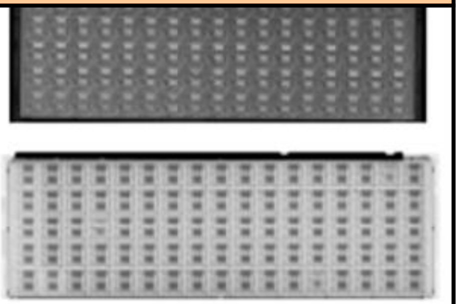
Test Item*	Qualification Test Condition	Test Result	
		results	criterion
Before Test	/	PASS	NA
Pre-con	Baking:125，24 hrs Moisture Soak： 30℃/60%RH,192hrs Reflow@260 *3times	PASS	J-STD-020E
uHAST	130℃, 85%RH 33.3psia,unbiased 192hrs	PASS	JESD22-A118B
TCB	-55℃~125℃, 1000cycles	PASS	JESD22-A104E

HYSOL GR910 FOR BGA

EMC Type			GR910K16	GR910L26
Formula info	Resin		BP/MAR	BP
	Hardener		MFN/MAR	PN/MAR
	Filler ratio（%）		86.5	88
	Filler cut （μm）		53	53
	Filler type		Spherical	Spherical
Spiral flow		cm	191	160
Gelation time		sec	38	37
Tg (TMA)		℃	165	119
a1 (TMA)		10^{-6}/℃	11	8
a2 (TMA)		10^{-6}/℃	40	31
Flexural Modulus at RT		MPa	16639	19521
Flexural Strengths at RT		MPa	131	126
Modulus by DMA	25℃	MPa	23792	21874
	175℃	MPa	1238	436
	260℃	MPa	771	381
Tg (DMA, peak of tanδ)		℃	163	21874
Shrinkage after PMC		%	0.26	0.13
Water absorption（PCT24H）		%	0.34	0.35
Remark		-	BGA	LGA

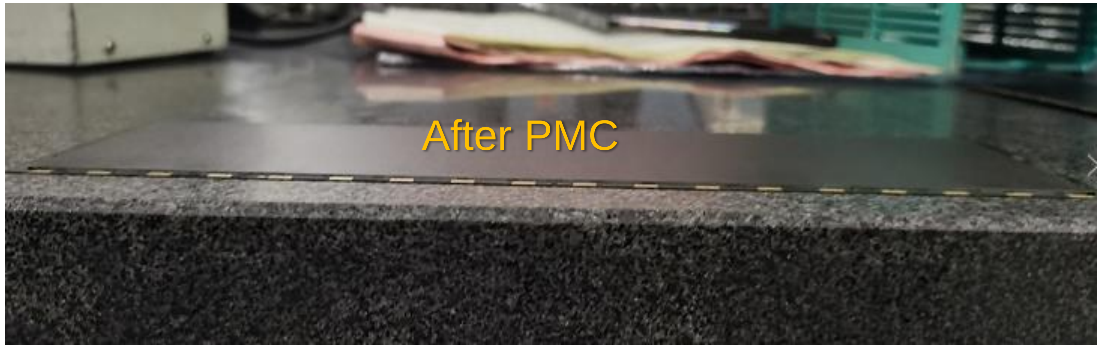
GR910K16 BETA SITE PERFORMANCE IN HT**

BGA	Mold cap	Strip size	PKG	Die 1 size	Die 2 size
	0.7mm	240.5*76.3*0.26mm	13*13.4mm	3.41*4.94*0.19mm	5.57*3.65*0.15um

EMC	Wire sweep ratio	SAT -Wire sweep	Strip Warpage	Photo - warpage	SAT-delamination
K16	3.89/2.56/4.03(%) spec： < 5%		3.21/3.45/3.62（mm） spec：<5mm		

GR910L26 BETA SITE PERFORMANCE IN JC**

LGA	Mold cap	基板尺寸	PKG	Die 1 size	Die 2 size	Die 3 size
	0.47mm	240.5*76.3mm	5*5mm	780*640um	1230*980um	890*950um



Wire sweep	Warpage after molding	Warpage after PMC	Warpage after reflow	Void	Au finger 0 delam after MSL3
7.67%	0.65mm	-0.26mm	1.74	None	0/22

LAB CAPACITY

Internal Assembly Capability

- BGA
- QFN
- QFP44
- SOP8
- SOP28
- TO252–DPAK
- TO3P
- TO247
- TO220

FA Capability

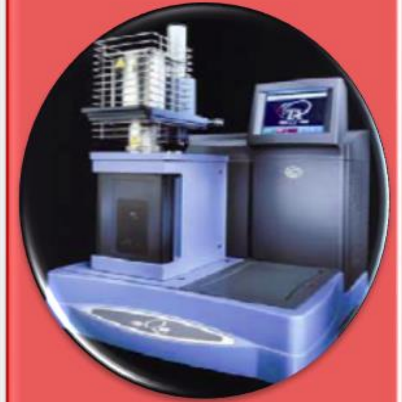
- C-SAM
- X-Ray
- X-section
- Microscope
- SEM&EDX
- Laser decape

Reliability Evaluation Capability

- Reflow oven
- Moisture chamber
- HAST chamber
- HTRB chamber/ Tester system
- PCT
- TCT

Characteristic test

- Adhesion Test
  - Tab-pull tester
  - Button shear
- Mechanical property
  - Universal testing machine
- Electrical performance
  - Dielectric strength
  - CTI
  - Volume resistivity
  - DETA



Material analysis

- Thermal Analysis
  - DSC
  - TMA
  - DMA
  - TGA
  - TC
- Chemical analysis
  - Ion Chromatography
  - Atomic absorption spectrograph system
  - FTIR analysis

Others

- A30,A50,A75 line
- Laser particle size analysis
- Potentiometric titrimeter
- Conductivity meter
- Flammability test

Thank you